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RESEARCH ARTICLE

Contribution to the Salpingidae (Coleoptera, Tenebrionoidea) of Greece including new faunistic records and ecological data on a poorly studied family

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Abstract

Salpingidae are a small family of beetles living mainly under the bark of deciduous forest trees and conifers, feeding on fungi, organic matter and other insects. A total of 23 species are known in the Western Palearctic out of which only six have been recorded in Greece. Material surveys of the first author during the last decades unveil ten species of Salpingidae for the country. Four species, *Salpingus ruficollis* (Linnaeus, 1760), *Sphaeriestes castaneus* (Panzer, 1796), *Sphaeriestes exsanguis* (Abeille de Perrin, 1870) and *Vincenzellus ruficollis* (Panzer, 1794) are reported from Greece for the first time. These records are presented alongside a literature survey regarding Greek Salpingidae, their overall distribution, ecology, host-plants and conservation status in the country.

Keywords

mycetophagous beetles, narrow-waisted bark beetles, Salpingidae, saproxylic beetles, *Salpingus ruficollis*, *Sphaeriestes castaneus*, *Sphaeriestes exsanguis*, *Vincenzellus ruficollis*.

Introduction

The family Salpingidae Leach, 1815 is comprised of approximately 350 species distributed across the world. Twenty-three species inhabit the Western Palearctic belonging to the subfamilies Agleninae Horn, 1878 and Salpinginae Leach, 1815

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(Pollock and Löbl 2008). Salpingidae (narrow-waisted bark beetles) are mostly found in forests, where they live mainly under the bark of trees feeding on fungi and other insects, although the ecology of most Salpingidae is rather poorly understood (Barnouin and Zagatti 2017). Amongst these species, *Aglenus brunneus* (Gyllenhal, 1813) is considered as cryptogenic (Denux and Zagatti 2010) [i.e. of unknown origin (Carlton 1996)], probably introduced to Europe (Barnouin and Zagatti 2017) and currently widespread (Pollock and Löbl 2008). This species has been strongly associated with human habitations where it infests cultivated mushrooms, stored products and grain but also residing in decomposing organic matter (e.g. guano and manure) (Denux and Zagatti 2010; Barnouin and Zagatti 2017).

According to Pollock and Löbl (2008), four species of the family Salpingidae have been recorded from Greece. However, past overlooked literature records (von Oertzen 1886) as well as more recent research endeavours (Chehlarov et al. 2016) have raised this number to six species in total. In particular, the following species are known to inhabit Greece: *A. brunneus*, *Cariderus aeneus* (Olivier, 1807), *Lissodema denticollis* (Gyllenhal, 1813), *Salpingus planirostris* (Fabricius, 1787), *Sphaeriestes aeratus* (Mulsant, 1859) and *Sphaeriestes reyi* (Abeille de Perrin, 1874) (von Oertzen 1886; Pollock and Löbl 2008; Chehlarov et al. 2016; Popa et al. 2019).

Materials and methods

Locality data on Greek Salpingidae were extrapolated and corrected from the available scientific literature, citizen-science platforms (iNaturalist 2022) as well as specimens deposited in the private collection of the first author (GK) and Mr Thomas Barnouin (Laboratoire National d'Entomologie Forestière, Office National des Forêts) (TB) (Appendix 1). Data were mapped using QGIS Version 3.18.2 free and open source Geographic Information System (https://qgis.org/en/site/) (Fig. 1).

Results

Material examined:

Subfamily Agleninae Horn, 1878
Aglenus brunneus (Gyllenhal, 1813)
Peloponnese, Messinia, Mani, near Stoupa village [36.85°N; 22.26°E], 31.I.2004, alt. 100 m, leg. G. Kakiopoulos, shallow cave soil, occasional dead specimens under stones (2 collected) (GK); Peloponnese, Lakonia, Mt. Taygetos near Trypi village [37.09°N; 22.35°E], 15.IV.2007, alt. 700 m, leg. G. Kakiopoulos, entrance of shallow cave, 1 individual (alive) under stone (GK).

Subfamily Salpinginae Leach, 1815
Cariderus aeneus (Olivier, 1807)
Western Greece, Aitoloakarnania, Mt. Arakynthos [38.47°N; 21.47°E], 17.I.2004, alt. 800 m, leg. G. Kakiopoulos, 1 specimen under the bark of a young dry deciduous *Quercus* sp. (GK); Thessaly, Karditsa, near Portitsa village [39.31°N; 21.81°E], 14.XI.2010, alt. 300 m, leg. G. Kakiopoulos, 1 specimen collected by beating dry branches of deciduous *Quercus* sp. (GK).

Lissodema denticollis (Gyllenhal, 1813)
Central Macedonia, Chalkidiki, Mt. Stratonikon between Olympiada and Neochorion villages [40.54°N; 23.70°E], 28.VI.2007, alt. 800 m, leg. G. Kakiopoulos, 2 specimens collected by beating dead *Fagus sylvatica* L. branches (GK); Western Macedonia, Florina, south bank of lake Cheimaditida [40.61°N; 21.57°E], 25.V.2010, alt. 600 m, leg. G. Kakiopoulos, 1 specimen collected by beating *Populus* sp. branches (GK); Western Greece, Achaea, near Valta village [38.11°N; 22.06°E], 13.VII.2014, alt. 950 m, leg. G. Kakiopoulos, 1 specimen collected by beating *Platanus orientalis* L. branches (GK).

Salpingus ruficollis (Linnaeus, 1760) – New record for Greece
East Macedonia and Thrace, Kavala, Mt Pangaion [40.91°N; 24.09°E], 29.IX.2002, alt. 1450 m, leg. G. Kakiopoulos, 1 specimen under *Fagus sylvatica* L. bark (GK) (Fig. 2A).

Salpingus planirostris (Fabricius, 1787)
Central Macedonia, Mt. Pieria towards Mt. Titaros [40.09°N; 22.26°E], 28.IV.2002, alt. 1600 m, leg. G. Kakiopoulos, 1 specimen under *Fagus sylvatica* L. bark (GK); Central Macedonia, Chalkidiki, Mt. Stratonikon between Olympiada and Neochorion villages [40.54°N; 23.70°E], 28.VI.2007, alt. 800 m, leg. G. Kakiopoulos, 2 specimens collected by beating dead *Fagus sylvatica* L. branches (species very common at the site) (GK); Thessaly, Volos [39.383523°N; 22.9736°E], 23.X.2021, alt. 130 m, obs. C. Kazilas, ident. G. Kakiopoulos, 1 individual (https://www.inaturalist.org/observations/102398968).

Sphaeriestes aeratus (Mulsant, 1859)
Central Greece, Euboea, near Pagondas village [38.67°N; 23.58°E], 12.XI.2004, alt. 450 m, leg. G. Kakiopoulos, 1 specimen collected by beating *Pinus halepensis* Mill. branches (GK).

Sphaeriestes castaneus (Panzer, 1796) – New record for Greece
East Macedonia and Thrace, Xanthi, near Leivaditis village, Chaidou forest [41.30°N; 24.66°E], 09.VII.2007, alt. 1150 m, leg. G. Kakiopoulos, 1 teratological specimen (9-segmented antennae), collected by beating *Pinus sylvestris* L. branches (GK) (Fig. 2B).

Sphaeriestes exsanguis (Abeille de Perrin, 1870) – New record for Greece
North Aegean, Lesvos island, 6 km NW of Myloi Lampou [39.18°N; 26.35°E], 19.X.2005, leg. G. Kakiopoulos, 2 specimens collected by beating *Pinus brutia* Ten. branches (GK) (Fig. 2C); Dodecanese, Rhodes island, Kritinia castel [36.26°N; 27.81°E], 01.IV.2009, leg. Pierre Berger, 1 specimen (TB).

Sphaeriestes reyi (Abeille de Perrin, 1874)
Western Greece, Achaea, Aroania village [37.88°N; 22.01°E], 29.IX.1996, alt. 700 m, leg. G. Kakiopoulos, 1 specimen under the bark of dead tree (GK); Epirus, Ioannina, Mt. Smolikas, Palioselli village area [40.04°N; 20.88°E], 07.X.2003, alt. 1100 m, leg. G. Kakiopoulos, 1 specimen under the bark of cut *Pinus nigra* J.F. Arnold tree (GK); North Aegean, Lesvos island, Mt. Ordymnos, Antissa area [39.23°N; 25.93°E], 18.X.2005, alt. 650 m, leg. G. Kakiopoulos, 1 specimen on stone (GK).

Vincenzellus ruficollis (Panzer, 1794) – New record for Greece
Western Macedonia, Mt. Smolikas, Samarina village area [40.09°N; 20.99°E], 11.V.2002, alt. 1900 m, leg. G. Kakiopoulos, 1 specimen on a fallen *Fagus sylvatica* L. tree trunk (GK) (Fig. 2D).

Literature records:

Aglenus brunneus (Gyllenhal, 1813)
Attica, leg. E. von Oertzen (von Oertzen 1886); Crete, leg. E. von Oertzen (von Oertzen 1886); Greece (Pollock and Löbl 2008); Thessaly, Larissa, between Kefolovryso and Palaiokastro, cave Melissotrypa [39.87°N; 22.05°E], 2013–2018, alt. 299 m, in hypogenic cave that contains a sulfidic lake (Popa et al. 2019); Crete, Chania, Chordaki, cave Koutrouli [35.55°N; 24.16°E] (Coiffait 1955; Beron 2016; Paragamian 2021).

Lissodema denticollis (Gyllenhal, 1813)
Central Macedonia, Chalkidiki Peninsula, Arnea [Arnaia] [40.48°N; 23.59°E], 15.VII.2008, leg. and ident. L. Fancello, 1 individual under *Fagus* sp., leaf-litter sifting (in L. Fancello collection) (Chehlarov et al. 2016).

Cariderus aeneus (Olivier, 1807)
Western Greece, Ileia, leg. U. Brenske (von Oertzen 1886); Greece (Pollock and Löbl 2008).

Salpingus planirostris (Fabricius, 1787)
Western Greece, Ileia, leg. E. von Oertzen (von Oertzen 1886).

Sphaeriestes aeratus (Mulsant, 1859)
Greece (Pollock and Lobl 2008).

Sphaeriestes reyi (Abeille de Perrin, 1874)
Crete (Iablokoff-Khnzorian 1985); Greece (Kriti = Crete) (Pollock and Löbl 2008).

Discussion

In this article, an additional four species are added to the catalogue of Greek Salpingidae, raising their overall number to ten species. The study of Greek Salpingidae can be largely attributed to opportunistic material surveys with early reports providing no detail regarding precise localities, the habitat and ecology of reported species (von Oertzen 1886; Iablokoff-Khnzorian 1985). Despite the small number of records traced in the scientific literature, the total of 18 additional records, provide important distributional and ecological data for ten species inhabiting Greece (Fig. 1). For example, the recent discovery of *L. denticollis* in Greece (Chehlarov et al. 2016) is supplemented by three records of the species from Northern Greece and Peloponnese collected on beech, poplar and plane trees. Although, *L. denticollis* is known to be polyphagous (Barnouin and Zagatti 2017) *P. orientalis* and *Populus* sp. are recorded for the first time as its hosts.

Throughout the examination of specimens collected by the first author and Mr. T. Barnouin, *Salpingus ruficollis* (Linnaeus, 1760), *Sphaeriestes castaneus* (Panzer, 1796),

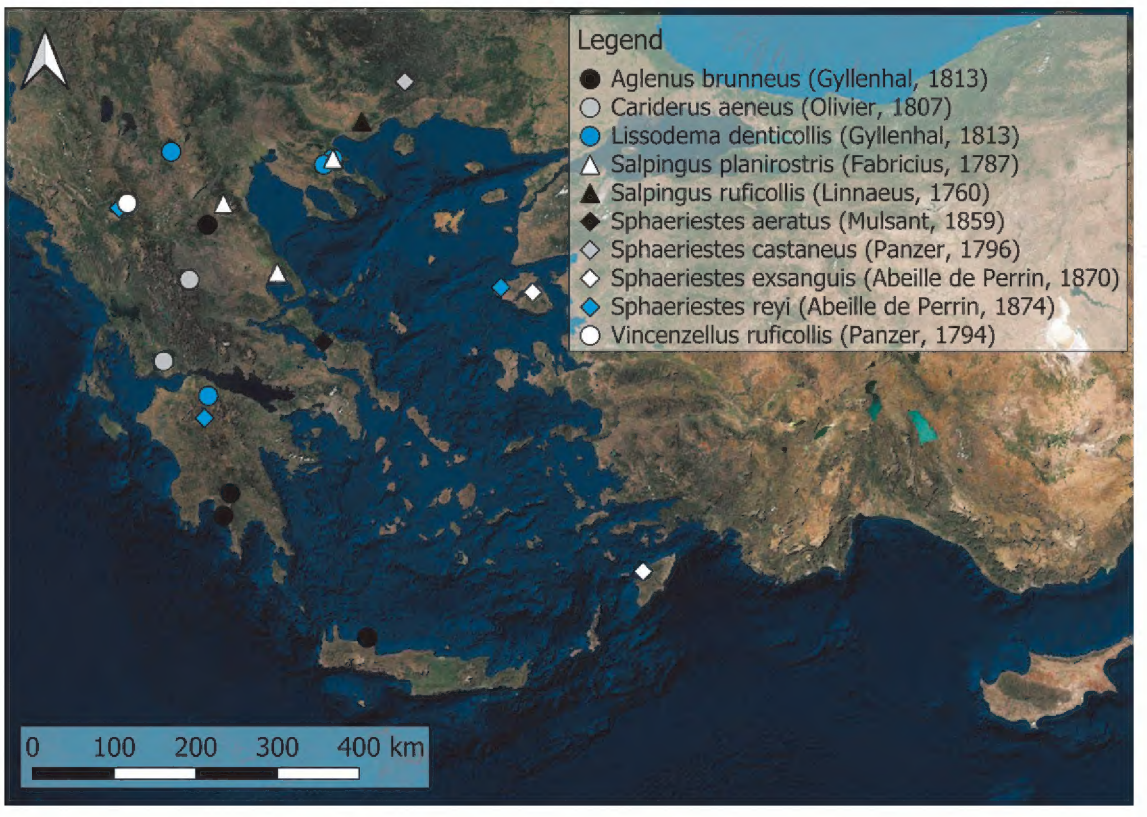
Legend
Aglenus brunneus (Gyllenhal, 1813)
Cariderus aeneus (Olivier, 1807)
Lissodema denticollis (Gyllenhal, 1813)
Salpingus planirostris (Fabricius, 1787)
Salpingus ruficollis (Linnaeus, 1760)
Sphaeriestes aeratus (Mulsant, 1859)
Sphaeriestes castaneus (Panzer, 1796)
Sphaeriestes exsanguis (Abeille de Perrin, 1870)
Sphaeriestes reyi (Abeille de Perrin, 1874)
Vincenzellus ruficollis (Panzer, 1794)
0 100 200 300 400 km

Figure 1. Georeferenced records of Greek Salpingidae according to the available literature and examined material. Locality records covering a large geographic area e.g. von Oertzen (1886) and Iablokoff-Khnzorian (1985) are not depicted.

Sphaeriestes exsanguis (Abeille de Perrin, 1870) and *Vincenzellus ruficollis* (Panzer, 1794) are recorded for the first time in Greece (Fig. 2A–D). The lone teratological specimen of *S. castaneus* with 9-segmented antennae is of additional importance as it constitutes an interesting record of teratogenesis in Salpingidae. Such an abnormity initially obstructed the correct identification of the specimen although, all remaining morphological characters were consistent with those of *S. castaneus* (Barnouin and Zagatti 2017). Furthermore, *S. exsanguis*, previously known from France (including Corsica) (Iablokoff-Khnzorian 1985), Portugal (Fuente 1932) and Spain (Lencina et al. 2008) was collected from Lesvos and Rhodes islands, suggesting its extended distribution not only in Western Europe but also towards the Eastern Mediterranean and probably in neighbouring Turkey.

Regarding the cryptogenic *A. brunneus*, it has been said to originate from North America (de Peyerimhoff 1945) although, this statement has been reviewed as rather controversial (Buckland et al. 2009). The species has been discovered in multiple archaeological sites across Northern Europe (Kenward 1975, 1976; Griffin et al. 1988; Kenward and Allison 1994; O'Brien et al. 2005; Buckland et al. 2009) as well as in Egypt, where an accidental introduction by the Romans has been hypothesised (Panagiotakopulu and van der Veen 1997). All the aforementioned records correspond to peri-domestic habitats or human mediated transportations, suggesting *A. brunneus* being highly synanthropic, widespread and probably native to the Old World (Buckland et al. 2009; Denux and Zagatti 2010; Barnouin and Zagatti 2017). In Greece, the species has been collected from caves in Crete (Coiffait 1955; Beron 2016; Paragamian 2021), Thessaly (Popa et al. 2019; Paragamian 2021) and Peloponnese (present article) while, such troglophilic encounters have also been reported from Corsica (Coache 2009) and Iran (Sadeghi et al. 2014). It is impossible to know whether these records represent human-mediated transportations to caves although, the presence of *A. brunneus* in such remote habitats where human interaction is rather minimal, raise further questions regarding the nativity or not of *A. brunneus* in Greece and by extend in the Palearctic.

The remaining species were mostly associated with forest trees of the genera *Fagus*, *Pinus*, *Populus* and *Quercus* according to their ecological preferences (Iablokoff-Khnzorian 1985; Barnouin and Zagatti 2017). *Sphaeriestes aeratus*, a rather rare Palearctic species (Iablokoff-Khnzorian 1985) was collected from branches of *P. halepensis* as opposed to the bark of fir and beech trees, as mentioned in the available literature (Barnouin and Zagatti 2017). Nevertheless, the biology of *S. aeratus* is still considered as poorly known (Barnouin and Zagatti 2017), with our results suggesting its additional dwelling on pines.

Up to date the extinction risk of European Salpingidae has been addressed in the regional Red List of Italian saproxylic beetles, where only *Sphaeriestes bimaculatus* (Gyllenhal, 1810) has been assessed as threatened [vulnerable (VU) under the IUCN criteria] (Carpaneto et al. 2015). In addition, nine Salpingidae are regarded as nearly threated (NT) in Italy, including the native to Greece *S. ruficollis*, *S. aeratus*, *S. castaneus* and *S. reyi* (Carpaneto et al. 2015). Taking into consideration the scarcity

of published data on Greek Salpingidae, as well as the numerous threats encountered by European saproxylic beetles (Cálix et al. 2018), future research in the country could emphasize on material sampling and assessment of the extinction risk of Greek Salpingidae. Conservation actions minimizing some of the major threats to saproxylic beetles such as logging, tree loss and wood harvesting, urbanisation and tourism development or the increase in fire frequency/intensity (Cálix et al. 2018) could also benefit rarely encountered or potentially threatened species of Salpingidae.

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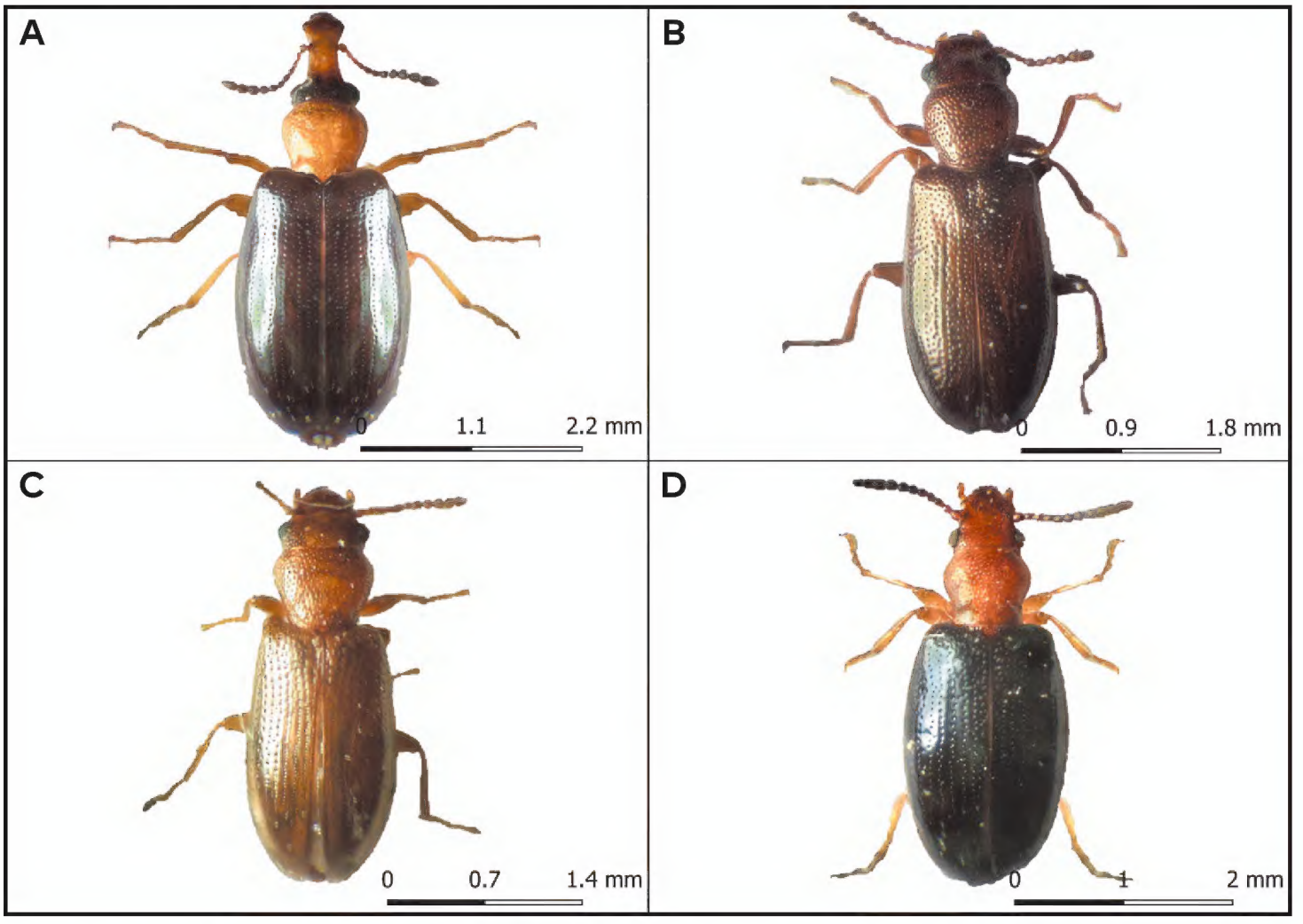

Figure 2. Dorsal view of *Salpingus ruficollis* (Linnaeus, 1760) (A), *Sphaeriestes castaneus* (Panzer, 1796) (B), *Sphaeriestes exsanguis* (Abeille de Perrin, 1870) (C) and *Vincenzellus ruficollis* (Panzer, 1794) (D), new records for Greece deposited in the private collection of G. Kakiopoulos.

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Appendix 1. Literature records and examined material of Greek Salpingidae.

Species	Coordinates (decimal)	Altitude (m)	Locality	Date (DD/MM/YYYY)	Leg.; Ident.	Habitat	Notes
Aglenus brunneus	36.85, 22.26	100	Peloponnese, Messinia, Mani, near Stoupa village	31.I.2004	G. Kakiopoulos	shallow cave soil, occasional dead specimens under stones	in GK collection
Aglenus brunneus	37.09, 22.35	700	Peloponnese, Lakonia, Mt Taygetos near Trypi village	15.IV.2007	G. Kakiopoulos	entrance of shallow cave	in GK collection
Aglenus brunneus	N/A	N/A	Attica	N/A	E. von Oertzen	N/A	von Oertzen (1886)
Aglenus brunneus	N/A	N/A	Crete	N/A	E. von Oertzen	N/A	von Oertzen (1886)
Aglenus brunneus	N/A	N/A	N/A	N/A	N/A	N/A	Pollock and Lobl (2008)
Aglenus brunneus	39.87, 22.05	299	Thessaly, Larissa, between Kefolovryso and Palaiokastro, cave Melissotrypa	2013-2018	N/A	in hypogenic cave that contains a sulfidic lake	Popa et al. (2019)
Aglenus brunneus	35.55, 24.16	N/A	Crete, Chania, Chordaki, cave Koutrouli	N/A	N/A	N/A	Coiffait (1955); Beron (2016); Paragamian (2021)
Cariderus aeneus	38.47, 21.47	800	Western Greece, Aitoloakarnania, Mt Arakynthos	17.I.2004	G. Kakiopoulos	under the bark of a young dry deciduous *Quercus* sp.	in GK collection
Cariderus aeneus	39.31, 21.81	300	Thessaly, Karditsa, near Portitsa village	14.XI.2010	G. Kakiopoulos	collected by beating dry branches of deciduous *Quercus* sp.	in GK collection
Cariderus aeneus	N/A	N/A	Western Greece, Ileia	N/A	U. Brenske; E. von Oertzen	N/A	von Oertzen (1886)
Cariderus aeneus	N/A	N/A	N/A	N/A	N/A	N/A	Pollock and Lobl (2008)
Lissodema denticolle	40.54, 23.71	800	Central Macedonia, Chalkidiki, Mt Stratonikon between Olympiada and Neochorion villages	28.VI.2007	G. Kakiopoulos	collected by beating dead *Fagus sylvatica* L. branches	in GK collection
Lissodema denticolle	40.61, 21.57	600	Western Macedonia, Florina, south bank of lake Cheimaditida	25.V.2010	G. Kakiopoulos	collected by beating *Populus* sp. branches	in GK collection
Lissodema denticolle	38.11, 22.06	950	Western Greece, Achaea, near Valta village	13.VII.2014	G. Kakiopoulos	collected by beating *Platanus orientalis* L. branches	in GK collection
Lissodema denticolle	40.48, 23.59	N/A	Central Macedonia, Chalkidiki Peninsula, Arnea [Arnaia]	15.VII.2008	L. Fancello	individual under *Fagus* sp., leaf-litter sifting	Chehlarov et al. (2016)
Salpingus ruficollis	40.91, 24.09	1450	East Macedonia and Thrace, Kavala, Mt Pangaion	29.IX.2002	G. Kakiopoulos	under *Fagus sylvatica* L. bark	in GK collection; new record for Greece

Appendix 1. (continued)

Species	Coordinates (decimal)	Altitude (m)	Locality	Date (DD/MM/YYYY)	Leg.; Ident.	Habitat	Notes
Salpingus planirostris	40.09, 22.26	1600	Central Macedonia, Mt Pieria towards Mt Titaros	28.IV.2002	G. Kakiopoulos	under *Fagus sylvatica* L. bark	in GK collection
Salpingus planirostris	40.54, 23.71	800	Central Macedonia, Chalkidiki, Mt Stratonikon between Olympiada and Neochorion villages	28.VI.2007	G. Kakiopoulos	collected by beating dead *Fagus sylvatica* L. branches (very common at the site)	in GK collection
Salpingus planirostris	39.3835, 22.9736	130	Thessaly, Volos	23.X.2021	C. Kazilas; G. Kakiopoulos	observed; online at: https://www.inaturalist.org/observations/102398968	iNaturalist
Salpingus planirostris	N/A	N/A	Western Greece, Ileia	N/A	E. von Oertzen	N/A	von Oertzen (1886)
Sphaeriestes aeratus	38.67, 23.58	450	Central Greece, Euboea, near Pagondas village	12.XI.2004	G. Kakiopoulos	collected by beating Pinus halepensis Mill. branches	in GK collection
Sphaeriestes aeratus	N/A	N/A	N/A	N/A	N/A	N/A	Pollock and Lobl (2008)
Sphaeriestes castaneus	41.31, 24.66	1150	East Macedonia and Thrace, Xanthi, near Leivaditis village, Chaidou forest	09.VII.2007	G. Kakiopoulos	1 teratological specimen, collected by beating *Pinus sylvestris* L. branches	in GK collection; new record for Greece
Sphaeriestes exsanguis	39.18, 26.35	N/A	North Aegean, Lesvos island, 6 km NW of Myloi Lampou	19.X.2005	G. Kakiopoulos	collected by beating Pinus brutia Ten. branches	in GK collection; new record for Greece
Sphaeriestes exsanguis	36.26, 27.81	N/A	South Aegean, Dodecanese, Rhodes island, Kritinia castel	01.IV.2009	Pierre Berger; Thomas Barnouin		in TB collection; new record for Greece
Sphaeriestes reyi	37.88, 22.01	700	Western Greece, Achaea, Aroania village	29.IX.1996	G. Kakiopoulos	specimen under the bark of dead tree	in GK collection
Sphaeriestes reyi	40.04, 20.88	1100	Epirus, Ioannina, Mt Smolikas, Palioselli village area	07.X.2003	G. Kakiopoulos	specimen under the bark of cut *Pinus nigra* J.F. Arnold tree	in GK collection
Sphaeriestes reyi	39.23, 25.93	650	North Aegean, Lesvos island, Mt Ordymnos, Antissa area	18.X.2005	G. Kakiopoulos	specimen on stone	in GK collection
Sphaeriestes reyi	N/A	N/A	Crete	N/A	S.M. Iablokoff-Khnzorian	N/A	Iablokoff-Khnzorian 1985
Sphaeriestes reyi	N/A	N/A	N/A	N/A	N/A	N/A	Pollock and Lobl (2008)
Vincenzellus ruficollis	40.09, 20.99	1900	Western Macedonia, Mt Smolikas, Samarina village area	11.V.2002	G. Kakiopoulos	specimen on a fallen *Fagus sylvatica* L. tree trunk	in GK collection; new record for Greece